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Bilsborough

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(54) **SYSTEMS AND METHODS FOR ARCHIVING RELATED ITEMS**

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This patent is subject to a terminal disclaimer.

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**Related U.S. Application Data**

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(51) **Int. Cl.**
***G06F 17/30*** (2006.01)
***H04L 29/08*** (2006.01)

(52) **U.S. Cl.**
CPC ......... ***G06F 17/30073*** (2013.01); ***H04L 67/10*** (2013.01)

(58) **Field of Classification Search**
USPC .................................................. 707/661, 667
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 6,745,197 | B2 * | 6/2004 | McDonald | G06Q 10/107 |
| 7,761,429 | B2 * | 7/2010 | Polimeni | G06Q 10/107<br>707/668 |
| 8,032,493 | B2 * | 10/2011 | Gong | G06F 17/30306<br>707/661 |
| 8,058,892 | B2 * | 11/2011 | Satou | G01R 1/045<br>324/500 |
| 8,171,087 | B2 * | 5/2012 | Carrer | G06Q 10/00<br>709/205 |
| 8,458,263 | B1 * | 6/2013 | Ruben | H04L 12/586<br>707/661 |
| 8,701,046 | B2 * | 4/2014 | McCann | G06F 17/30528<br>709/206 |
| 9,235,641 | B1 * | 1/2016 | Kumar | G06F 17/30864 |
| 2004/0133645 | A1 * | 7/2004 | Massanelli | G06F 17/2205<br>709/206 |
| 2004/0221295 | A1 * | 11/2004 | Kawai | G06Q 10/107<br>719/313 |
| 2006/0224846 | A1 | 10/2006 | Amarendran et al. | |
| 2007/0038710 | A1 * | 2/2007 | Li | G06Q 10/107<br>709/206 |
| 2008/0172462 | A1 * | 7/2008 | Carrer | G06Q 10/00<br>709/204 |
| 2008/0250084 | A1 | 10/2008 | Polimeni | |
| 2009/0198729 | A1 | 8/2009 | Gong | |
| 2014/0208227 | A1 * | 7/2014 | McCann | G06F 17/30528<br>715/752 |

OTHER PUBLICATIONS

Phelan, Thomas, "Google Email—Reading Email", https://webapps.peddie.org/KB/KnowledgebaseArticle10090.aspx, as accessed on Jul. 2, 2009, (Jun. 2, 2008).

* cited by examiner

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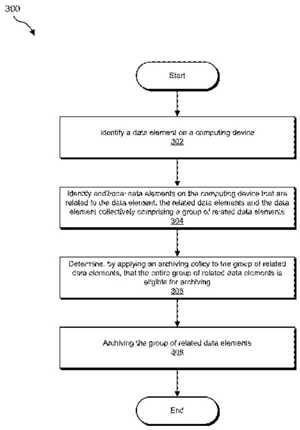
(57) **ABSTRACT**

A computer-implemented method for archiving related items may include: 1) identifying a data element on a computing device, 2) identifying at least one additional data element on the computing device that is related to the data element, the data element and the additional related data element collectively representing a group of related data elements, 3) determining, by applying an archiving policy to the group of related data elements, that the entire group of related data elements is eligible for archiving, and then 4) archiving the group of related data elements. Corresponding systems and computer-readable media are also disclosed.

**19 Claims, 7 Drawing Sheets**


300
Start
identify a data element on a computing device
302
Identify additional data elements on the computing device that are related to the data element, the related data elements and the data element collectively comprising a group of related data elements
304
Determine, by applying an archiving policy to the group of related data elements, that the entire group of related data elements is eligible for archiving
306
Archiving the group of related data elements
308
End

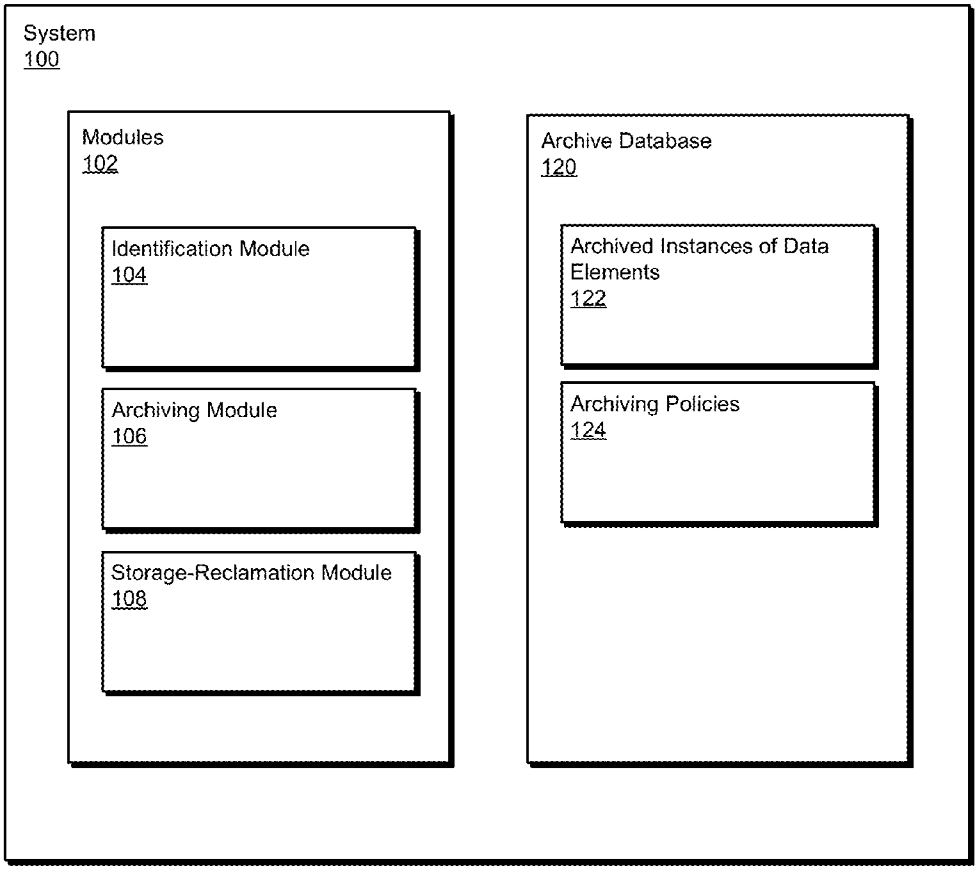

System
100
Modules
102
Identification Module
104
Archiving Module
106
Storage-Reclamation Module
108
Archive Database
120
Archived Instances of Data Elements
122
Archiving Policies
124

*FIG. 1*

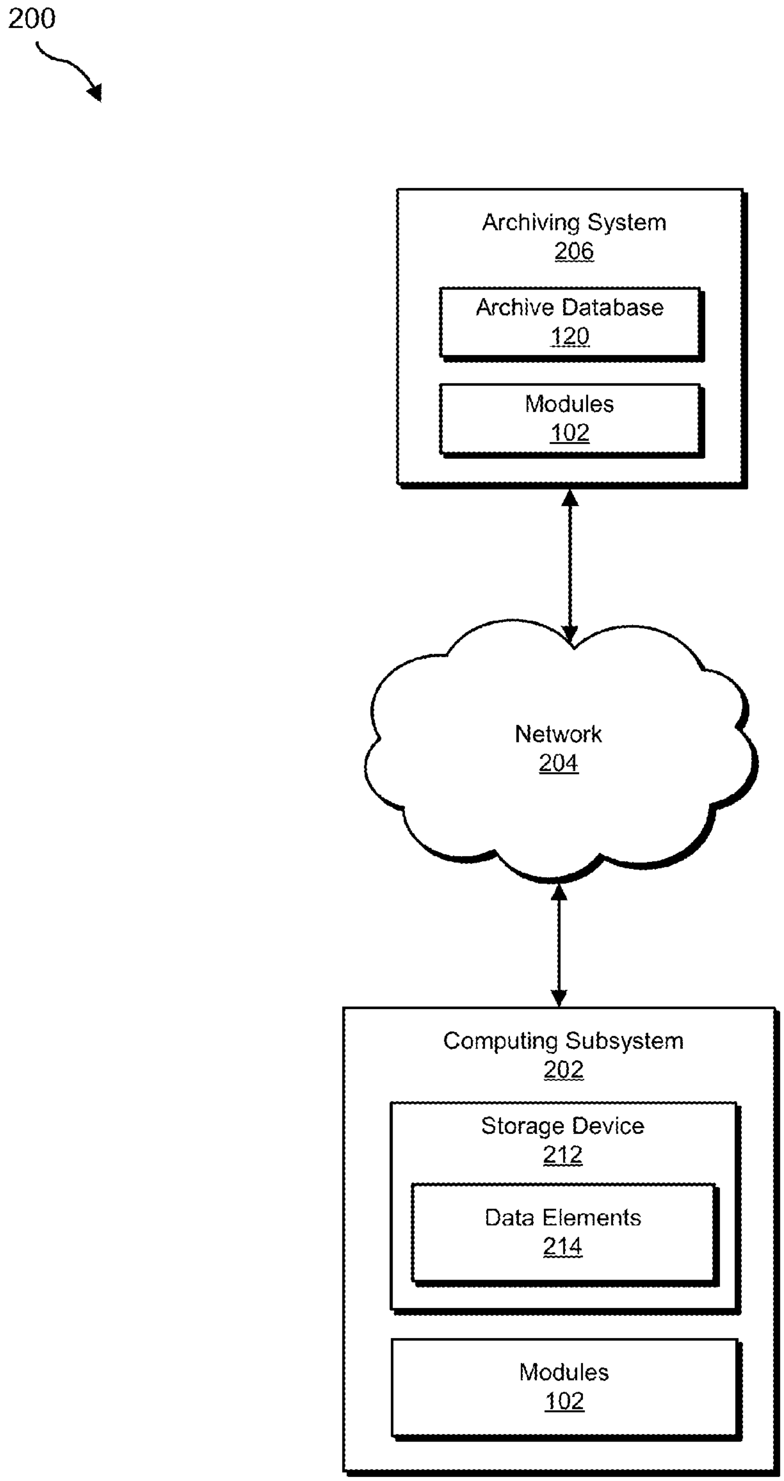

200
Archiving System
206
Archive Database
120
Modules
102
Network
204
Computing Subsystem
202
Storage Device
212
Data Elements
214
Modules
102

*FIG. 2*

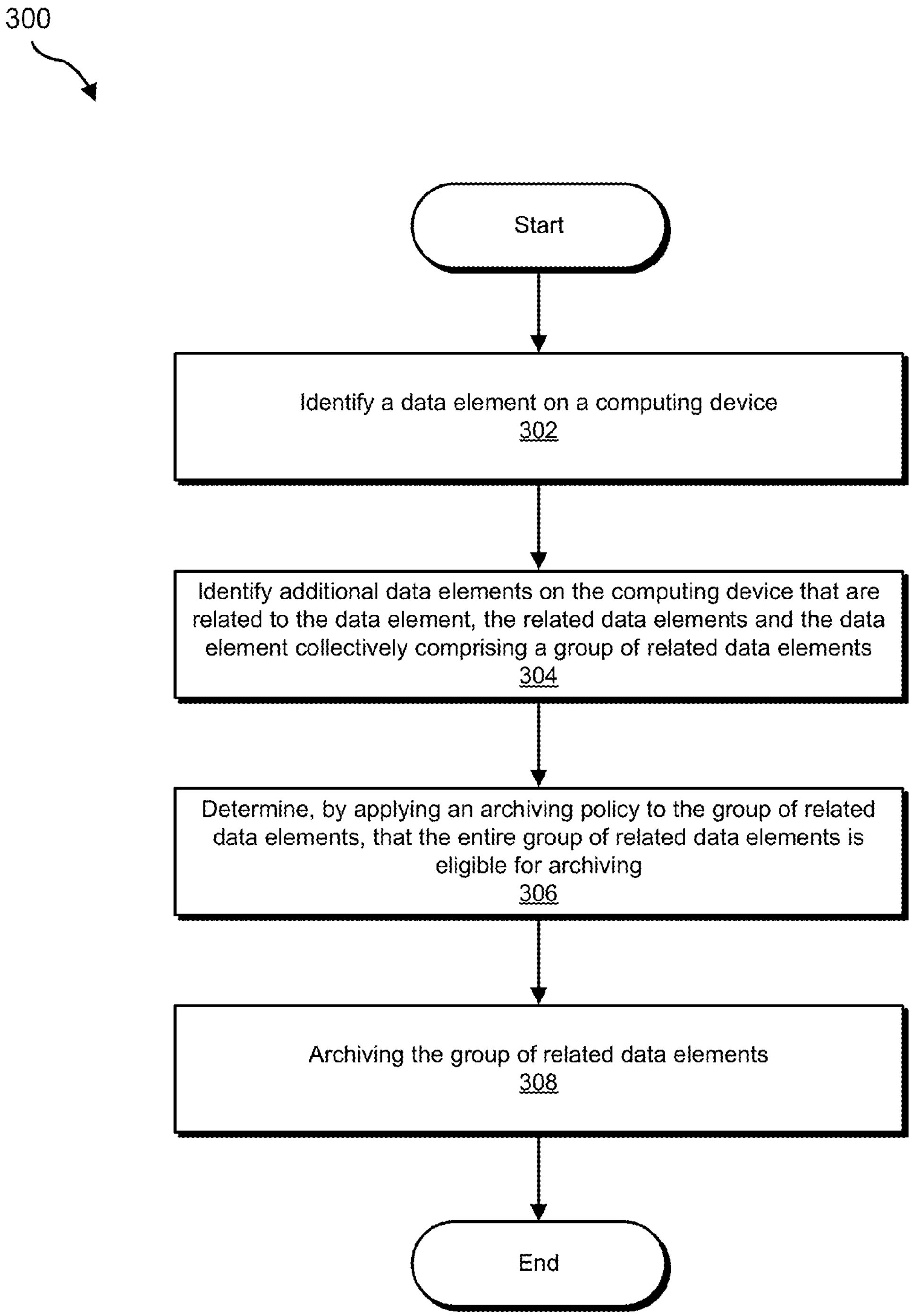
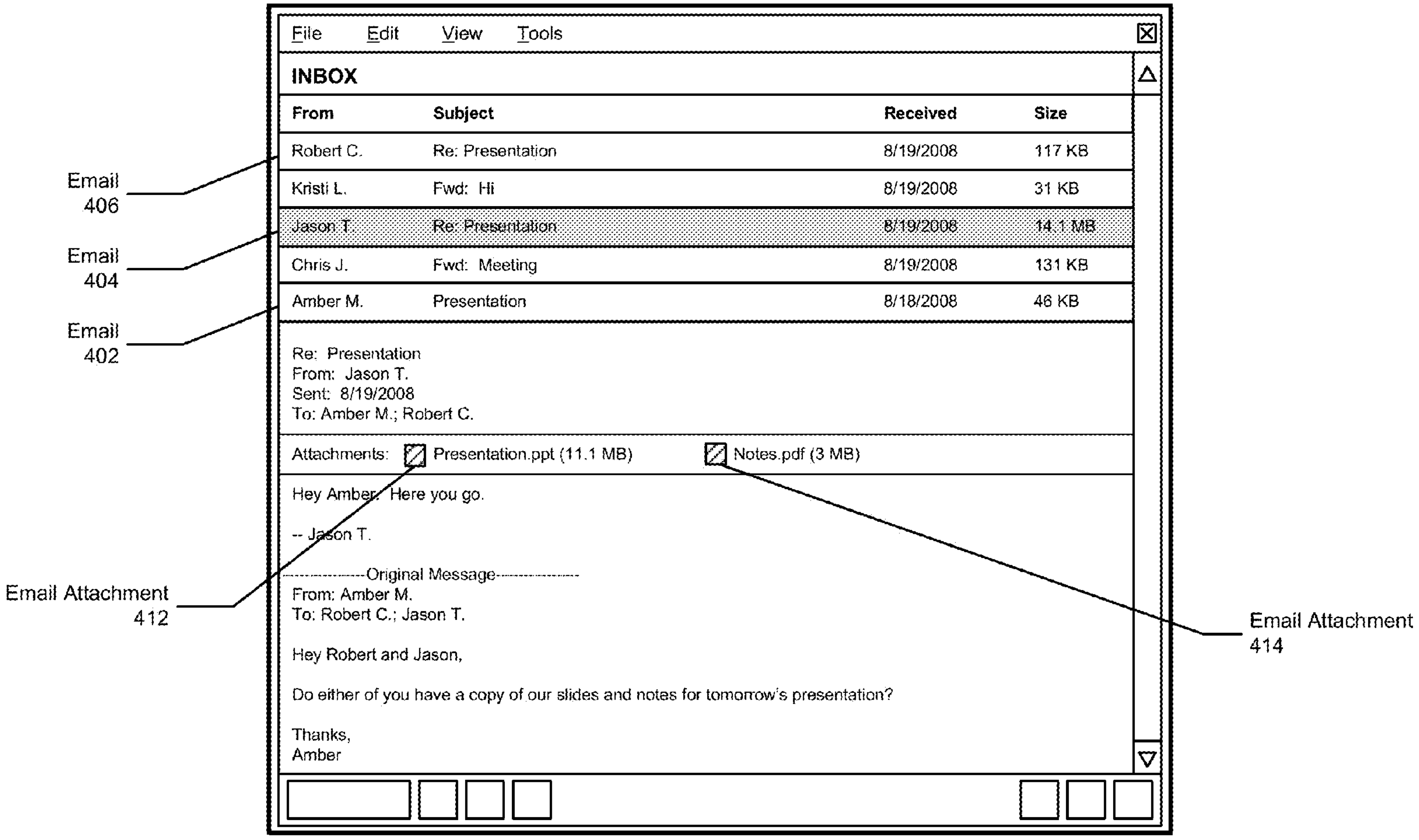

300
Start
Identify a data element on a computing device
302
Identify additional data elements on the computing device that are related to the data element, the related data elements and the data element collectively comprising a group of related data elements
304
Determine, by applying an archiving policy to the group of related data elements, that the entire group of related data elements is eligible for archiving
306
Archiving the group of related data elements
308
End

*FIG. 3*



| From | Subject | Received | Size |
|---|---|---|---|
| Robert C. | Re: Presentation | 8/19/2008 | 117 KB |
| Kristi L. | Fwd: Hi | 8/19/2008 | 31 KB |
| Jason T. | Re: Presentation | 8/19/2008 | 14.1 MB |
| Chris J. | Fwd: Meeting | 8/19/2008 | 131 KB |
| Amber M. | Presentation | 8/18/2008 | 46 KB |

Re: Presentation
From: Jason T.
Sent: 8/19/2008
To: Amber M.; Robert C.

Attachments: ▨ Presentation.ppt (11.1 MB) ▨ Notes.pdf (3 MB)

Hey Amber. Here you go.

-- Jason T.

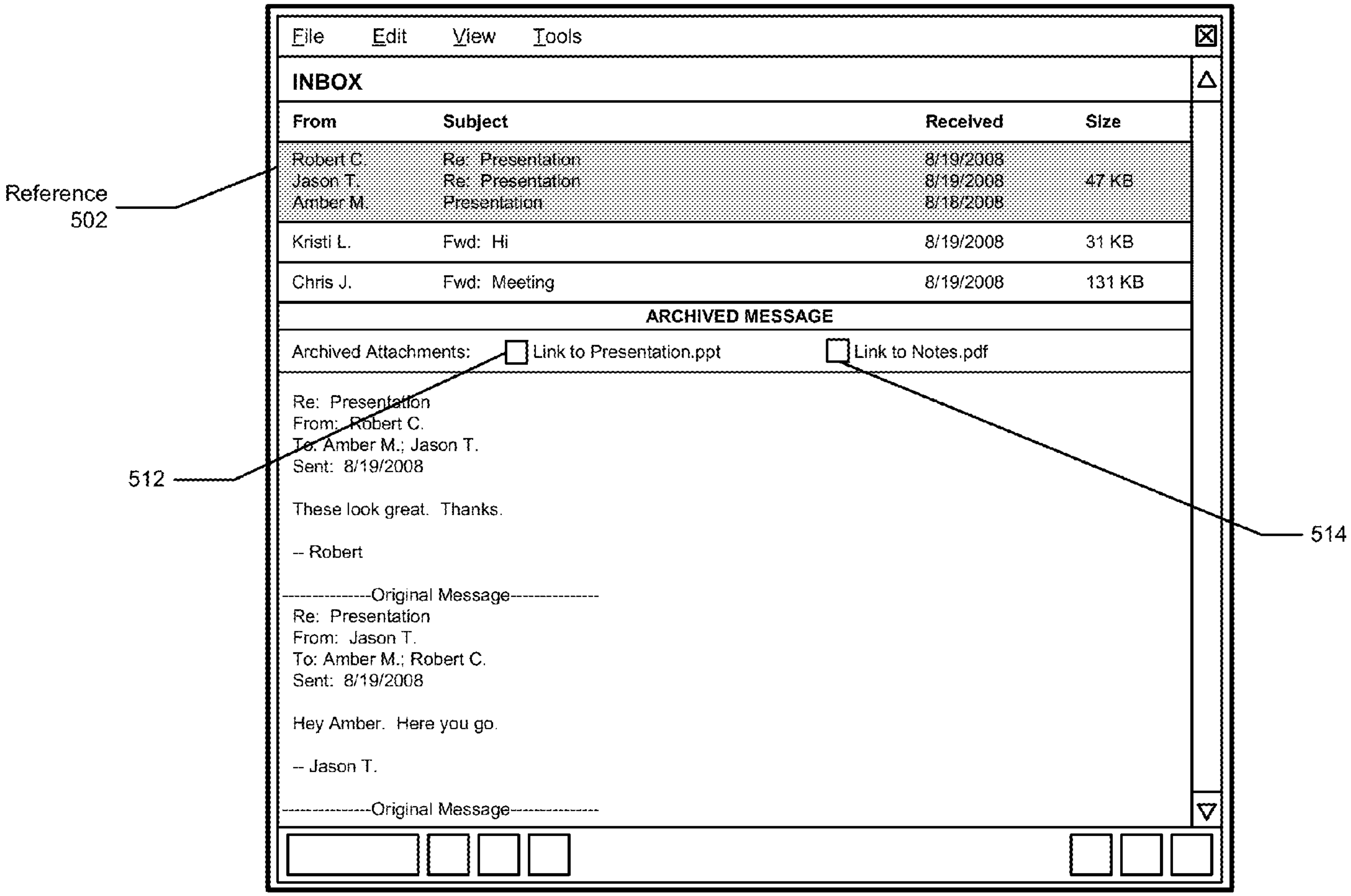
-----------------Original Message-----------------
From: Amber M.
To: Robert C.; Jason T.

Hey Robert and Jason,

Do either of you have a copy of our slides and notes for tomorrow's presentation?

Thanks,
Amber

FIG. 4



INBOX

| From | Subject | Received | Size |
|---|---|---|---|
| Robert C.<br>Jason T.<br>Amber M. | Re: Presentation<br>Re: Presentation<br>Presentation | 8/19/2008<br>8/19/2008<br>8/18/2008 | 47 KB |
| Kristi L. | Fwd: Hi | 8/19/2008 | 31 KB |
| Chris J. | Fwd: Meeting | 8/19/2008 | 131 KB |

ARCHIVED MESSAGE

Archived Attachments: □ Link to Presentation.ppt □ Link to Notes.pdf

Re: Presentation
From: Robert C.
To: Amber M.; Jason T.
Sent: 8/19/2008

These look great. Thanks.

-- Robert

---------------Original Message---------------
Re: Presentation
From: Jason T.
To: Amber M.; Robert C.
Sent: 8/19/2008

Hey Amber. Here you go.

-- Jason T.

---------------Original Message---------------

FIG. 5

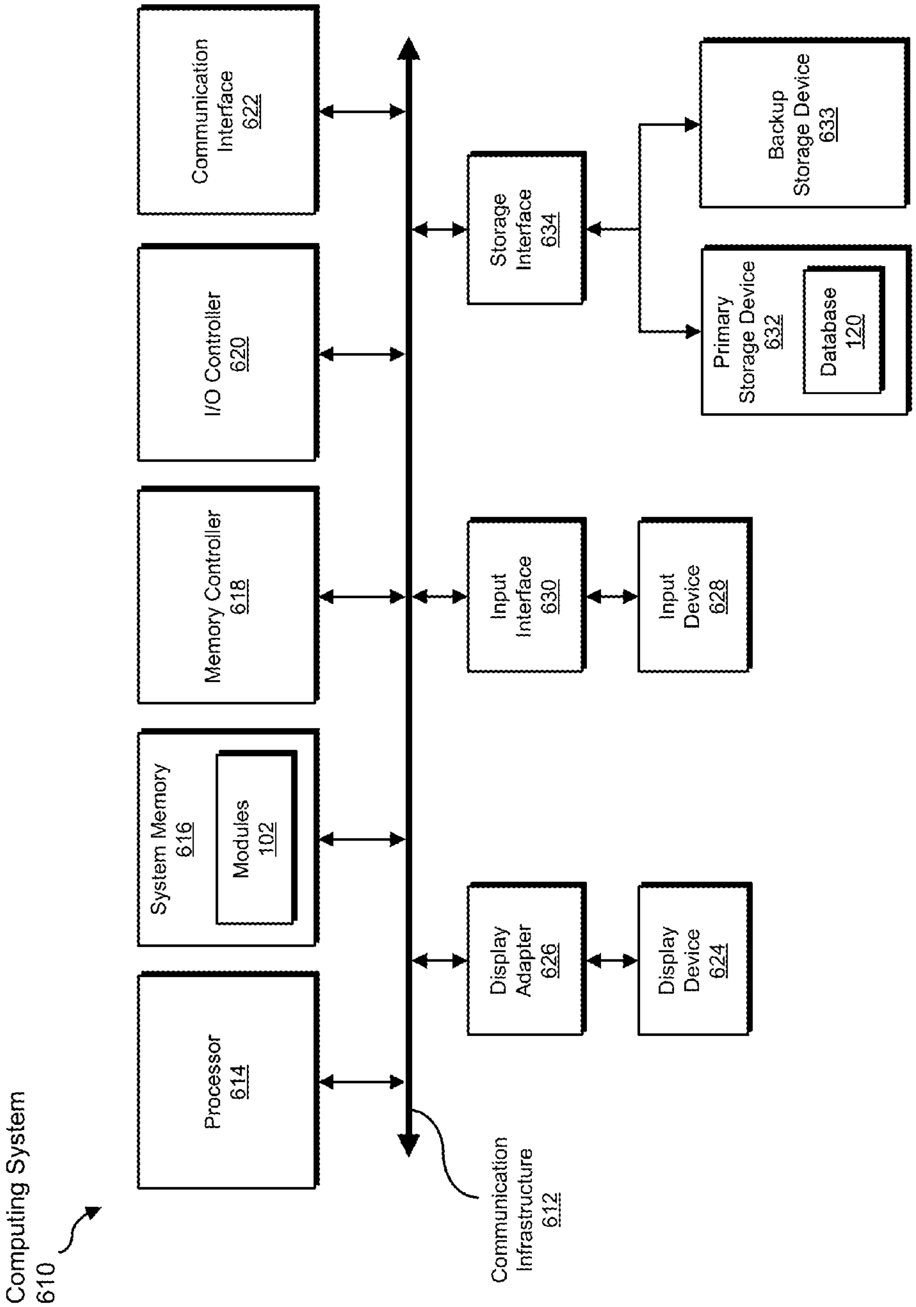

Computing System
610
Processor
614
System Memory
616
Modules
102
Memory Controller
618
I/O Controller
620
Communication
Interface
622
Communication
Infrastructure
612
Display
Adapter
626
Display
Device
624
Input
Interface
630
Input
Device
628
Storage
Interface
634
Primary
Storage Device
632
Database
120
Backup
Storage Device
633

FIG. 6

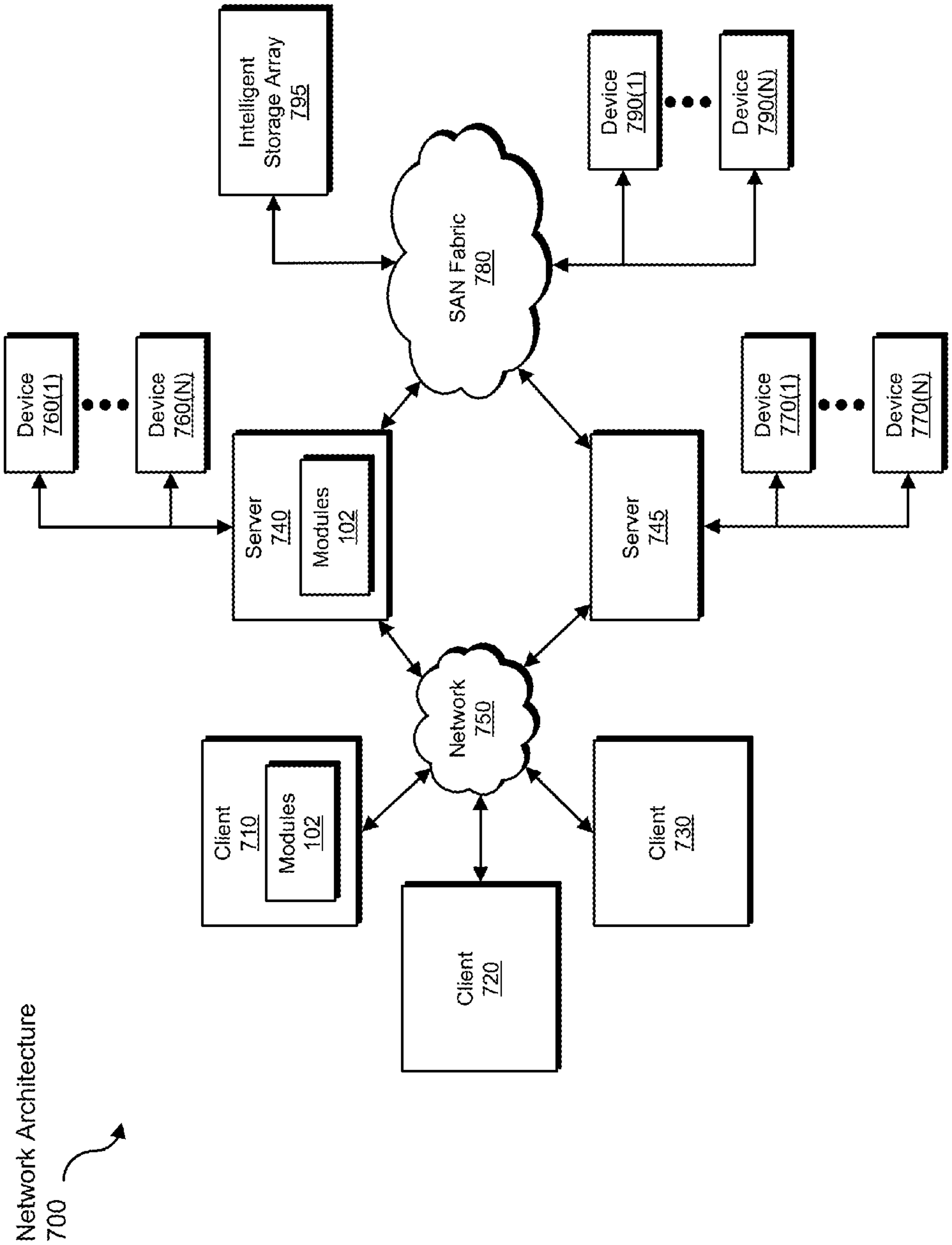

Network Architecture
700
Client
710
Modules
102
Client
720
Client
730
Network
750
Server
740
Modules
102
Server
745
Device
760(1)
Device
760(N)
Device
770(1)
Device
770(N)
SAN Fabric
780
Intelligent
Storage Array
795
Device
790(1)
Device
790(N)

FIG. 7

# SYSTEMS AND METHODS FOR ARCHIVING RELATED ITEMS

## CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. application Ser. No. 12/550,709, filed 31 Aug. 2009, the disclosure of which is incorporated, in its entirety, by this reference.

## BACKGROUND

Archiving systems (such as email-archiving systems) typically copy data elements (such as emails) from a source system to an archived system in order to conserve storage resources on the source system. For example, an email-archiving system may archive emails on a computing system that are more than one year old in order to free up the storage space occupied by these emails on the computing system.

Unfortunately, conventional archiving systems typically archive data elements without regard for their potential relationship to other data elements. For example, an email-archiving system may archive a first email in a conversation thread (if, for example, this email is more than one year old) without archiving a second or third email in the same conversation thread (if, for example, these subsequent emails are less than one year old). In this example, this may result in archiving and removing emails from an active email-conversation thread, potentially leading to user frustration.

Moreover, because conventional archiving systems typically provide a discrete link or shortcut to each archived data element, the number of links or references placed on a computing system for a single email-conversation thread may continually increase as additional emails are added to the conversation thread and later archived. As such, the instant disclosure identifies a need for systems and methods for improved archiving of related items.

## SUMMARY

The instant disclosure generally relates to systems and methods for archiving related items. In one example, and as will be described in greater detail below, one or more of the exemplary systems described herein may accomplish this task by: 1) receiving a request to archive a data element (such as an email) on a computing device (from, e.g., a user or administrator of the computing device), 2) identifying at least one additional data element on the computing device that is related to the data element (e.g., additional emails from the same conversation thread as the first email), 3) determining, by applying an archiving policy to this group of related data elements, that the entire group of related data elements is eligible for archiving, and then 4) archiving the entire group of related data elements.

In one example, each of the related data elements may share at least one property (such as file name, file size, file-creation/modification date, file type, or the like) in common. For example, the systems described herein may determine that a group of emails are related if these emails are part of the same email-conversation thread (as indicated by, for example, each email's subject line, sender/recipient list, or the like).

In some examples, the systems described herein may, upon archiving the group of related data elements, remove these data elements from the computing device. The systems described herein may then create a single reference on the computing device that points to the archived group of related data elements. In some examples, this reference may include an amalgamation of the properties of the group of data elements (such as, e.g., an identification of each unique sender/recipient within an email-conversation thread). In at least one example, the systems described herein may also assign a unique identifier to this archived group of related data elements.

By identifying and determining whether each data element within a group of related data elements is eligible for archiving prior to archiving any of the data elements, the systems and methods described herein may prevent archiving systems from archiving one data element within a group of related data elements without archiving the other related data elements. This may prevent, for example, an archiving system from archiving only a portion of emails in a conversation thread. Moreover, by creating and providing a single reference or shortcut to an entire group of archived/related data elements, as opposed to creating a separate reference or shortcut for each archived data element, the systems and methods described herein may conserve storage space and improve storage management on endpoint devices.

Features from any of the above-mentioned embodiments may be used in combination with one another in accordance with the general principles described herein. These and other embodiments, features, and advantages will be more fully understood upon reading the following detailed description in conjunction with the accompanying drawings and claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate a number of exemplary embodiments and are a part of the specification. Together with the following description, these drawings demonstrate and explain various principles of the instant disclosure.

FIG. **1** is a block diagram of an exemplary system for archiving related items.

FIG. **2** is a block diagram of an exemplary system for archiving related items.

FIG. **3** is a flow diagram of an exemplary method for archiving related items.

FIG. **4** is a block diagram of an exemplary user interface containing a plurality of related emails.

FIG. **5** is a block diagram of the exemplary user interface in FIG. **4** containing a reference to an archived group of related emails.

FIG. **6** is a block diagram of an exemplary computing system capable of implementing one or more of the embodiments described and/or illustrated herein.

FIG. **7** is a block diagram of an exemplary computing network capable of implementing one or more of the embodiments described and/or illustrated herein.

Throughout the drawings, identical reference characters and descriptions indicate similar, but not necessarily identical, elements. While the exemplary embodiments described herein are susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and will be described in detail herein. However, the exemplary embodiments described herein are not intended to be limited to the particular forms disclosed. Rather, the instant disclosure covers all modifications, equivalents, and alternatives falling within the scope of the appended claims.

## DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

As will be described in greater detail below, the instant disclosure generally relates to systems and methods for archiving related items. The following will provide, with reference to FIGS. **1-2**, detailed descriptions of exemplary systems for performing this task. Detailed descriptions of corresponding computer-implemented methods will also be provided in connection with FIGS. **3-5**. In addition, detailed descriptions of an exemplary computing system and network architecture capable of implementing one or more of the embodiments described herein will be provided in connection with FIGS. **6** and **7**, respectively.

FIG. **1** is a block diagram of an exemplary system **100** for archiving related items. As illustrated in this figure, exemplary system **100** may include one or more modules **102** for performing one or more tasks. For example, and as will be explained in greater detail below, exemplary system **100** may include an identification module **104** programmed to identify, upon receiving a request to archive a data element, additional data elements that are related to the data element. Exemplary system **100** may also include an archiving module **106** programmed to archive groups of related data elements.

In addition, and as will be described in greater detail below, exemplary system **100** may include a storage-reclamation module **108** programmed to remove archived groups of data elements from computing devices in order to reclaim storage space. Although illustrated as separate elements, one or more of modules **102** in FIG. **1** may represent portions of a single module or application.

In certain embodiments, one or more of modules **102** in FIG. **1** may represent one or more software applications or programs that, when executed by a computing device, may cause the computing device to perform one or more tasks. For example, as will be described in greater detail below, one or more of modules **102** may represent software modules stored and configured to run on one or more computing devices, such as the devices illustrated in FIG. **2** (e.g., computing subsystem **202** and/or archiving system **206**), computing system **610** in FIG. **6**, and/or portions of exemplary network architecture **700** in FIG. **7**. One or more of modules **102** in FIG. **1** may also represent all or portions of one or more special-purpose computers configured to perform one or more tasks.

As illustrated in FIG. **1**, exemplary system **100** may also include one or more databases. For example, system **100** may include an archive database **120** for storing archived instances **122** of data elements, as will be discussed in greater detail below. In some examples, archive database **120** may also store one or more archiving policies **124**, as detailed below.

Database **120** may represent portions of a single database or computing device or a plurality of databases or computing devices. For example, database **120** may represent a portion of archiving system **206** in FIG. **2**, computing system **610** in FIG. **6**, and/or portions of exemplary network architecture **700** in FIG. **7**. Alternatively, database **120** may represent one or more physically separate devices capable of being accessed by a computing device, such as archiving system **206** in FIG. **2**, computing system **610** in FIG. **6**, and/or portions of exemplary network architecture **700** in FIG. **7**.

Exemplary system **100** in FIG. **1** may be deployed in a variety of ways. For example, all or a portion of exemplary system **100** may represent portions of a cloud-computing or network-based environment, such as exemplary system **200** illustrated in FIG. **2**. Cloud-computing environments may provide various services and applications via the Internet. These cloud-based services (e.g., software as a service, platform as a service, infrastructure as a service, etc.) may be accessible through a web browser or other remote interface. Various functions described herein may be provided through a remote desktop environment or any other cloud-based computing environment.

As shown in FIG. **2**, system **200** may include a computing subsystem **202** in communication with an archiving system **206** via a network **204**. In one embodiment, and as will be described in greater detail below, modules **102** may program archiving system **206** (and/or computing subsystem **202**) to: 1) identify a data element (such as one of data elements **214**) on computing subsystem **202**, 2) identify at least one additional data element on the computing subsystem **202** that is related to the data element (in this example, the data element and the additional related data element may collectively represent a group of related data elements), 3) determine, by applying an archiving policy (such as one or more of archiving policies **124** in FIG. **1**) to the group of related data elements, that the entire group of related data elements is eligible for archiving, and then 4) archive the group of related data elements.

Computing subsystem **202** generally represents any type or form of computing device capable of reading computer-executable instructions. Examples of computing subsystem **202** include, without limitation, laptops, desktops, servers, cellular phones, personal digital assistants (PDAs), multimedia players, embedded systems, combinations of one or more of the same, exemplary computing system **610** in FIG. **6**, or any other suitable computing device.

Archiving system **206** generally represents any type or form of computing device that is capable of archiving data elements (e.g., data elements **214** on computing subsystem **202**). Examples of archiving system **206** include, without limitation, application servers and database servers configured to provide various database services and/or run certain software applications.

Network **204** generally represents any medium or architecture capable of facilitating communication or data transfer. Examples of network **204** include, without limitation, an intranet, a wide area network (WAN), a local area network (LAN), a personal area network (PAN), the Internet, power line communications (PLC), a cellular network (e.g., a GSM Network), exemplary network architecture **700** in FIG. **7**, or the like. Network **204** may facilitate communication or data transfer using wireless or wired connections. In one embodiment, network **204** may facilitate communication between computing subsystem **202** and archiving system **206**.

FIG. **3** is a flow diagram of an exemplary computer-implemented method **300** for archiving related items. The steps shown in FIG. **3** may be performed by any suitable computer-executable code and/or computing system. In some embodiments, the steps shown in FIG. **3** may be performed by one or more of the components of system **100** in FIG. **1** and/or system **200** in FIG. **2**.

At step **302** in FIG. **3**, one or more of the various systems described herein may identify a data element on a computing device. For example, identification module **104** in FIG. **1** (which may, as detailed above, represent a portion of archiving system **206** in FIG. **2**) may identify a data element **214** on computing subsystem **202**.

Identification module **104** may perform step **302** in a variety of ways. In one example, identification module **104** may identify a data element by receiving a request to archive the data element. For example, a user of computing subsystem **202** may request that archiving system **206** archive an email **404** in FIG. **4** by selecting and designating this email for archiving. Similarly, an administrator of computing subsystem **202** may instruct archiving system **206** to archive various data elements (such as emails generated prior to a specified cutoff date) on computing subsystem **202**.

As detailed above, a data element may represent all or a portion of a file, all or a portion of an email, all or a portion of an email attachment, or any other type or form of data structure that may be archived and/or backed up. For example, the data element identified in step **302** may represent an email attachment **412** ("Presentation.ppt," having a file size of 11.1 MB) associated with email **404** in FIG. **4**. Alternatively, the data element identified in step **302** may represent the entirety of email **404**, including attachments **412** ("Presentation.ppt") and **414** ("Notes.pdf").

Returning to FIG. **3**, at step **304** the systems described herein may identify at least one additional data element on the computing device that is related to the data element identified at step **302**. For example, upon receiving a request to archive email **404** in FIG. **4**, identification module **104** may determine that emails **402** and **406** are related to email **404**. In some examples, these emails (i.e., emails **402**-**406**) may collectively represent a group of related emails (i.e., data elements).

Identification module **104** may identify related data elements in a variety of ways. In one example, identification module **104** may perform step **304** by identifying at least one additional data element that shares at least one property in common with the data element identified in step **302**. For example, identification module **104** may, upon receiving a request to archive email **404** in FIG. **4**, scan a user's email mailbox for email messages that share at least one property in common with email **404**.

Examples of properties that may be shared in common between data elements include, without limitation, file names, file sizes, file-creation dates, file-modification dates, file authors, file contents, file types, and/or any other file property. In the case of email messages, such properties may include, without limitation, email recipients, email senders, email subject lines, email contents, email file sizes, email attachments, email-attachment file sizes, email send dates, email received dates, and/or any other email property that may be used to identify relationships between email messages.

For example, in the example illustrated in FIG. **4**, identification module **104** may determine that emails **402** and **406** are related to email **404** since, for example: 1) the subject line ("Presentation") of each of these emails is identical, 2) the same individuals (in this example, "Robert C.," "Amber M.," and "Jason T.") are involved in each of these emails, 3) email **406** represents a reply to email **404** and email **404** represents a reply to email **402**, and/or **4**) the content of the body of email **406** contains the content of the body of email **404** (since email **406** represents a reply to email **404**) and the content of the body of email **404** contains the content of the body of email **402** (since email **404** represents a reply to email **402**).

Returning to FIG. **3**, at step **306** the systems described herein may determine, by applying an archiving policy to the group of related data elements identified in step **304**, that the entire group of related data elements is eligible for archiving. For example, archiving module **106** in FIG. **1** (which may, as detailed above, represent a portion of archiving system **206** in FIG. **2**) may determine, by applying one or more archiving policies **124** from FIG. **1** to emails **402**-**406**, that each of these emails is eligible for archiving.

The term "archiving policy," as used herein, generally refers to one or more rules and/or criteria that may be used to determine whether to archive a data element. Examples of criteria that may be included within an archiving policy include criteria relating to, without limitation, file name (e.g., criteria that specify archiving files having specific file names), file size (e.g., criteria that specify archiving files that are less than, greater than, or equal to specific file sizes), file-creation date (e.g., criteria that specify archiving files created on, before, or after a specific date), file-modification date (e.g., criteria that specify archiving files modified on, before, or after a specific date), file author (e.g., criteria that specify archiving files created by specific users), file content (e.g., criteria that specify archiving files that contain specific content, such as words or phrases), file type (e.g., criteria that specify archiving files of a specific type, such as ".doc" files), and/or any other file property (such as email properties, as detailed above).

Archiving module **106** may perform step **306** in a variety of ways. In one example, archiving module **106** may determine whether each data element within a group of related data elements satisfies the various criteria of an archiving policy. For example, in the case of an email-archiving policy that specifies archiving emails that are older than one year, archiving module **106** may determine that each of emails **402**-**406** are eligible for archiving since each of these emails was sent/received more than one year ago.

Returning to FIG. **3**, at step **308** the systems described herein may archive the entire group of related data elements identified in step **304**. For example, archiving module **106** in FIG. **1** may archive emails **402**-**406** in FIG. **4**.

Archiving module **106** may archive data elements in a variety of ways. In one example, archiving module **106** may archive a data element by creating an archived instance of the data element and then storing the same within archive database **120** of archiving system **206** in FIG. **2**. For example, archiving module **106** may create an archived instance for each of emails **402**-**406** and then store the same within archive database **120** of archiving system **206**. Upon completion of step **308**, exemplary method **300** in FIG. **3** may terminate.

In one example, upon archiving the group of related data elements at step **308**, the various systems described herein may remove this group of related data elements from the computing device. For example, storage-reclamation module **108** in FIG. **1** (which may, as detailed above, represent a portion of archiving system **206** and/or computing subsystem **202** in FIG. **2**) may instruct computing subsystem **202** to delete emails **402**-**406** from storage device **212**.

In some examples, upon removing these data elements, storage-reclamation module **108** may create a single reference, link, or shortcut on the computing device for the entire group of related data elements. For example, as illustrated in FIG. **5**, upon instructing computing subsystem **202** to remove emails **402**-**406** in FIG. **4** from storage device **212**, storage-reclamation module **108** may create a single reference **502** in FIG. **5** for this group of related email messages. In this example, reference **502** (which has a total file size of 47 KB, as opposed to the original emails, which collectively had a file size of over 14 MB) may be stored in place of emails **402**-**406** within the user's mailbox in FIG. **5**.

In some examples, reference **502** in FIG. **5** may point to archived instances of emails **402**-**406** stored in archive database **120** of archiving system **206** in FIG. **2**. Thus, when a user of computing subsystem **202** desires to access email attachment **412** of email **404**, for example, the user may select link **512** within reference **502**. Archiving module **106** may then restore attachment **412** by instructing computing subsystem **202** to download the archived instance of email **404** (which may include attachment **412**) from archive database **120** of archiving system **206**.

Stored-reclamation module **108** may create references to groups of related data elements in a variety of ways. In one example, storage-reclamation module **108** may: 1) amalgamate properties of at least two data elements within a group of data elements and then 2) include these amalgamated properties within a single reference or shortcut to this group of data elements. For example, storage-reclamation module **108** may, when creating reference **502** in FIG. **5** for emails **402-406**: 1) identify each unique sender/recipient contained within each of emails **402-406** (in this example, "Robert C.," "Jason T.," and "Amber M.") and then 2) display each of these unique senders/recipients within reference **502**.

In addition, in some examples an operation directed toward reference **502** in FIG. **5** may be applied to each of the data elements within the group of related data elements that are pointed to by this reference. For example, a user of computing subsystem **202** in FIG. **2** may request, by selecting or otherwise manipulating reference **502** in FIG. **5**, the deletion of each of emails **402-406**. Upon receiving this request, archiving module **106** may delete archived instances of emails **402-406** from archive database **120** of archiving system **206** in FIG. **2**. Applying operations in this manner may enable users to perform operations at a group-granularity level, as opposed to an individual-item granularity level.

Similarly, if a user of computing subsystem **202** performs a search operation on his/her mailbox in FIG. **5**, archiving module **106** may determine whether one or more of emails **402-406** satisfy the user's search query and, if so, return a single search result for the entire group of related emails (i.e., emails **402-406**), as opposed to returning a search result for each email within emails **402-406** that satisfies the user's search query. Additional examples of operations that may be applied to groups of related data elements include, without limitation, search operations, file operations (e.g., read, write, delete, or move operations), retrieve operations (e.g., operations that request retrieval of archived groups of data elements from an archiving system), or the like.

In some examples, archiving module **106** may assign a unique identifier to the group of related data elements archived in step **308**. For example, archiving module **106** may assign a unique identifier to the archived instances of emails **402-406**. Archiving module **106** may then store this unique identifier with each archived instance of emails **402-406** within archive database **120** of archiving system **206** in FIG. **2**. In some examples, this unique identifier may be used to identify groups of related data elements for deletion and/or retrieval purposes.

By identifying and determining whether each data element within a group of related data elements is eligible for archiving prior to archiving any of the data elements, the systems and methods described herein may prevent archiving systems from archiving one data element within a group of related data elements without archiving the other related data elements. This may prevent, for example, an archiving system from archiving only a portion of emails in a conversation thread. Moreover, by creating and providing a single reference or shortcut to an entire group of archived/related data elements, as opposed to creating a separate reference or shortcut for each archived data element, the systems and methods described herein may conserve storage space and improve storage management on endpoint devices.

FIG. **6** is a block diagram of an exemplary computing system **610** capable of implementing one or more of the embodiments described and/or illustrated herein. Computing system **610** broadly represents any single or multi-processor computing device or system capable of executing computer-readable instructions. Examples of computing system **610** include, without limitation, workstations, laptops, client-side terminals, servers, distributed computing systems, handheld devices, or any other computing system or device. In its most basic configuration, computing system **610** may include at least one processor **614** and a system memory **616**.

Processor **614** generally represents any type or form of processing unit capable of processing data or interpreting and executing instructions. In certain embodiments, processor **614** may receive instructions from a software application or module. These instructions may cause processor **614** to perform the functions of one or more of the exemplary embodiments described and/or illustrated herein. For example, processor **614** may perform and/or be a means for performing, either alone or in combination with other elements, one or more of the identifying, determining, archiving, receiving, applying, assigning, removing, creating, amalgamating, including, and returning steps described herein. Processor **614** may also perform and/or be a means for performing any other steps, methods, or processes described and/or illustrated herein.

System memory **616** generally represents any type or form of volatile or non-volatile storage device or medium capable of storing data and/or other computer-readable instructions. Examples of system memory **616** include, without limitation, random access memory (RAM), read only memory (ROM), flash memory, or any other suitable memory device. Although not required, in certain embodiments computing system **610** may include both a volatile memory unit (such as, for example, system memory **616**) and a non-volatile storage device (such as, for example, primary storage device **632**, as described in detail below). In one example, one or more of modules **102** from FIG. **1** may be loaded into system memory **616**.

In certain embodiments, exemplary computing system **610** may also include one or more components or elements in addition to processor **614** and system memory **616**. For example, as illustrated in FIG. **6**, computing system **610** may include a memory controller **618**, an Input/Output (I/O) controller **620**, and a communication interface **622**, each of which may be interconnected via a communication infrastructure **612**. Communication infrastructure **612** generally represents any type or form of infrastructure capable of facilitating communication between one or more components of a computing device. Examples of communication infrastructure **612** include, without limitation, a communication bus (such as an ISA, PCI, PCIe, or similar bus) and a network.

Memory controller **618** generally represents any type or form of device capable of handling memory or data or controlling communication between one or more components of computing system **610**. For example, in certain embodiments memory controller **618** may control communication between processor **614**, system memory **616**, and I/O controller **620** via communication infrastructure **612**. In certain embodiments, memory controller may perform and/or be a means for performing, either alone or in combination with other elements, one or more of the steps or features described and/or illustrated herein, such as identifying, determining, archiving, receiving, applying, assigning, removing, creating, amalgamating, including, and returning.

I/O controller **620** generally represents any type or form of module capable of coordinating and/or controlling the input and output functions of a computing device. For example, in certain embodiments I/O controller **620** may control or facilitate transfer of data between one or more elements of computing system **610**, such as processor **614**, system memory **616**, communication interface **622**, display adapter **626**, input interface **630**, and storage interface **634**. I/O controller **620** may be used, for example, to perform and/or be a means for performing, either alone or in combination with other elements, one or more of the identifying, determining, archiving, receiving, applying, assigning, removing, creating, amalgamating, including, and returning steps described herein. I/O controller **620** may also be used to perform and/or be a means for performing other steps and features set forth in the instant disclosure.

Communication interface **622** broadly represents any type or form of communication device or adapter capable of facilitating communication between exemplary computing system **610** and one or more additional devices. For example, in certain embodiments communication interface **622** may facilitate communication between computing system **610** and a private or public network including additional computing systems. Examples of communication interface **622** include, without limitation, a wired network interface (such as a network interface card), a wireless network interface (such as a wireless network interface card), a modem, and any other suitable interface. In at least one embodiment, communication interface **622** may provide a direct connection to a remote server via a direct link to a network, such as the Internet. Communication interface **622** may also indirectly provide such a connection through, for example, a local area network (such as an Ethernet network), a personal area network, a telephone or cable network, a cellular telephone connection, a satellite data connection, or any other suitable connection.

In certain embodiments, communication interface **622** may also represent a host adapter configured to facilitate communication between computing system **610** and one or more additional network or storage devices via an external bus or communications channel. Examples of host adapters include, without limitation, SCSI host adapters, USB host adapters, IEEE 1394 host adapters, SATA and eSATA host adapters, ATA and PATA host adapters, Fibre Channel interface adapters, Ethernet adapters, or the like. Communication interface **622** may also allow computing system **610** to engage in distributed or remote computing. For example, communication interface **622** may receive instructions from a remote device or send instructions to a remote device for execution. In certain embodiments, communication interface **622** may perform and/or be a means for performing, either alone or in combination with other elements, one or more of the identifying, determining, archiving, receiving, applying, assigning, removing, creating, amalgamating, including, and returning steps disclosed herein. Communication interface **622** may also be used to perform and/or be a means for performing other steps and features set forth in the instant disclosure.

As illustrated in FIG. **6**, computing system **610** may also include at least one display device **624** coupled to communication infrastructure **612** via a display adapter **626**. Display device **624** generally represents any type or form of device capable of visually displaying information forwarded by display adapter **626**. Similarly, display adapter **626** generally represents any type or form of device configured to forward graphics, text, and other data from communication infrastructure **612** (or from a frame buffer, as known in the art) for display on display device **624**.

As illustrated in FIG. **6**, exemplary computing system **610** may also include at least one input device **628** coupled to communication infrastructure **612** via an input interface **630**. Input device **628** generally represents any type or form of input device capable of providing input, either computer or human generated, to exemplary computing system **610**. Examples of input device **628** include, without limitation, a keyboard, a pointing device, a speech recognition device, or any other input device. In at least one embodiment, input device **628** may perform and/or be a means for performing, either alone or in combination with other elements, one or more of the identifying, determining, archiving, receiving, applying, assigning, removing, creating, amalgamating, including, and returning steps disclosed herein. Input device **628** may also be used to perform and/or be a means for performing other steps and features set forth in the instant disclosure.

As illustrated in FIG. **6**, exemplary computing system **610** may also include a primary storage device **632** and a backup storage device **633** coupled to communication infrastructure **612** via a storage interface **634**. Storage devices **632** and **633** generally represent any type or form of storage device or medium capable of storing data and/or other computer-readable instructions. For example, storage devices **632** and **633** may be a magnetic disk drive (e.g., a so-called hard drive), a floppy disk drive, a magnetic tape drive, an optical disk drive, a flash drive, or the like. Storage interface **634** generally represents any type or form of interface or device for transferring data between storage devices **632** and **633** and other components of computing system **610**. In one example, databases **120** from FIG. **1** may be stored in primary storage device **632**.

In certain embodiments, storage devices **632** and **633** may be configured to read from and/or write to a removable storage unit configured to store computer software, data, or other computer-readable information. Examples of suitable removable storage units include, without limitation, a floppy disk, a magnetic tape, an optical disk, a flash memory device, or the like. Storage devices **632** and **633** may also include other similar structures or devices for allowing computer software, data, or other computer-readable instructions to be loaded into computing system **610**. For example, storage devices **632** and **633** may be configured to read and write software, data, or other computer-readable information. Storage devices **632** and **633** may also be a part of computing system **610** or may be a separate device accessed through other interface systems.

In certain embodiments, storage devices **632** and **633** may be used, for example, to perform and/or be a means for performing, either alone or in combination with other elements, one or more of the identifying, determining, archiving, receiving, applying, assigning, removing, creating, amalgamating, including, and returning steps disclosed herein. Storage devices **632** and **633** may also be used to perform and/or be a means for performing other steps and features set forth in the instant disclosure.

Many other devices or subsystems may be connected to computing system **610**. Conversely, all of the components and devices illustrated in FIG. **6** need not be present to practice the embodiments described and/or illustrated herein. The devices and subsystems referenced above may also be interconnected in different ways from that shown in FIG. **6**. Computing system **610** may also employ any number of software, firmware, and/or hardware configurations. For example, one or more of the exemplary embodiments disclosed herein may be encoded as a computer program (also referred to as computer software, software applications, computer-readable instructions, or computer control logic) on a computer-readable medium. The phrase "computer-readable medium" generally refers to any form of device, carrier, or medium capable of storing or carrying computer-readable instructions. Examples of computer-readable media include, without limitation, transmission-type media, such as carrier waves, and physical media, such as magnetic-storage media (e.g., hard disk drives and floppy disks), optical-storage media (e.g., CD- or DVD-ROMs), electronic-storage media (e.g., solid-state drives and flash media), and other distribution systems.

The computer-readable medium containing the computer program may be loaded into computing system **610**. All or a portion of the computer program stored on the computer-readable medium may then be stored in system memory **616** and/or various portions of storage devices **632** and **633**. When executed by processor **614**, a computer program loaded into computing system **610** may cause processor **614** to perform and/or be a means for performing the functions of one or more of the exemplary embodiments described and/or illustrated herein. Additionally or alternatively, one or more of the exemplary embodiments described and/or illustrated herein may be implemented in firmware and/or hardware. For example, computing system **610** may be configured as an application specific integrated circuit (ASIC) adapted to implement one or more of the exemplary embodiments disclosed herein.

FIG. **7** is a block diagram of an exemplary network architecture **700** in which client systems **710**, **720**, and **730** and servers **740** and **745** may be coupled to a network **750**. Client systems **710**, **720**, and **730** generally represent any type or form of computing device or system, such as exemplary computing system **610** in FIG. **6**. In one example, client system **710** and/or server **740** may include modules **102** from FIG. **1**.

Similarly, servers **740** and **745** generally represent computing devices or systems, such as application servers or database servers, configured to provide various database services and/or run certain software applications. Network **750** generally represents any telecommunication or computer network including, for example, an intranet, a wide area network (WAN), a local area network (LAN), a personal area network (PAN), or the Internet.

As illustrated in FIG. **7**, one or more storage devices **760**(**1**)-(N) may be directly attached to server **740**. Similarly, one or more storage devices **770**(**1**)-(N) may be directly attached to server **745**. Storage devices **760**(**1**)-(N) and storage devices **770**(**1**)-(N) generally represent any type or form of storage device or medium capable of storing data and/or other computer-readable instructions. In certain embodiments, storage devices **760**(**1**)-(N) and storage devices **770**(**1**)-(N) may represent network-attached storage (NAS) devices configured to communicate with servers **740** and **745** using various protocols, such as NFS, SMB, or CIFS.

Servers **740** and **745** may also be connected to a storage area network (SAN) fabric **780**. SAN fabric **780** generally represents any type or form of computer network or architecture capable of facilitating communication between a plurality of storage devices. SAN fabric **780** may facilitate communication between servers **740** and **745** and a plurality of storage devices **790**(**1**)-(N) and/or an intelligent storage array **795**. SAN fabric **780** may also facilitate, via network

**750** and servers **740** and **745**, communication between client systems **710**, **720**, and **730** and storage devices **790**(**1**)-(N) and/or intelligent storage array **795** in such a manner that devices **790**(**1**)-(N) and array **795** appear as locally attached devices to client systems **710**, **720**, and **730**. As with storage devices **760**(**1**)-(N) and storage devices **770**(**1**)-(N), storage devices **790**(**1**)-(N) and intelligent storage array **795** generally represent any type or form of storage device or medium capable of storing data and/or other computer-readable instructions.

In certain embodiments, and with reference to exemplary computing system **610** of FIG. **6**, a communication interface, such as communication interface **622** in FIG. **6**, may be used to provide connectivity between each client system **710**, **720**, and **730** and network **750**. Client systems **710**, **720**, and **730** may be able to access information on server **740** or **745** using, for example, a web browser or other client software. Such software may allow client systems **710**, **720**, and **730** to access data hosted by server **740**, server **745**, storage devices **760**(**1**)-(N), storage devices **770**(**1**)-(N), storage devices **790**(**1**)-(N), or intelligent storage array **795**. Although FIG. **7** depicts the use of a network (such as the Internet) for exchanging data, the embodiments described and/or illustrated herein are not limited to the Internet or any particular network-based environment.

In at least one embodiment, all or a portion of one or more of the exemplary embodiments disclosed herein may be encoded as a computer program and loaded onto and executed by server **740**, server **745**, storage devices **760**(**1**)-(N), storage devices **770**(**1**)-(N), storage devices **790**(**1**)-(N), intelligent storage array **795**, or any combination thereof. All or a portion of one or more of the exemplary embodiments disclosed herein may also be encoded as a computer program, stored in server **740**, run by server **745**, and distributed to client systems **710**, **720**, and **730** over network **750**. Accordingly, network architecture **700** may perform and/or be a means for performing, either alone or in combination with other elements, one or more of the identifying, determining, archiving, receiving, applying, assigning, removing, creating, amalgamating, including, and returning steps disclosed herein. Network architecture **700** may also be used to perform and/or be a means for performing other steps and features set forth in the instant disclosure.

As detailed above, computing system **610** and/or one or more components of network architecture **700** may perform and/or be a means for performing, either alone or in combination with other elements, one or more steps of an exemplary method for archiving related items. In one example, this exemplary method may include: 1) identifying a data element on the computing device, 2) identifying at least one additional data element on the computing device that is related to the data element, the data element and the additional related data element collectively representing a group of related data elements, 3) determining, by applying an archiving policy to the group of related data elements, that the entire group of related data elements is eligible for archiving, and then 4) archiving the group of related data elements.

In some examples, identifying the data element may include receiving a request to archive the data element. In addition, identifying at least one additional data element that is related to the data element may include determining that the additional data element shares at least one property in common with the data element. This property may include a file name, a file size, a file-creation date, a file-modification date, a file author, file content, a file type, and/or a file property.

In one example, the data element may include an email, the additional data element may include a related email, and the property may include an email property. In this example, the email property may include an email recipient, an email sender, an email subject line, email content, an email file size, an email attachment, an email-attachment file size, an email send date, and/or an email receive date.

In some examples, applying the archiving policy to the group of related data elements may include determining whether each data element within the group of related data elements satisfies criteria relating to a file name, a file size, a file-creation date, a file-modification date, a file author, file content, a file type, and/or a file property. In addition, the method may also include assigning a unique identifier to the group of related data elements.

In one example, the method may also include removing the group of related data elements from the computing device. The method may also include creating a single reference on the computing device for the group of related data elements, with the reference pointing to the archived group of related data elements. In this example, creating the reference may include: 1) amalgamating properties of at least two data elements within the group of related data elements and then 2) including the amalgamated properties in the reference on the computing device.

The method may also include: 1) receiving a request, via the reference, to apply an operation to the group of related data elements and then 2) applying the operation to the archived group of related data elements. Examples of this operation may include a search operation, a delete operation, a retrieve operation, and/or a file operation.

In some examples, applying the search operation may include: 1) determining that a plurality of data elements within the group of related data elements satisfy a search query and then 2) returning a single search result for the entire group of related data elements, as opposed to returning a search result for each data element within the group of related data elements that satisfies the search query.

While the foregoing disclosure sets forth various embodiments using specific block diagrams, flowcharts, and examples, each block diagram component, flowchart step, operation, and/or component described and/or illustrated herein may be implemented, individually and/or collectively, using a wide range of hardware, software, or firmware (or any combination thereof) configurations. In addition, any disclosure of components contained within other components should be considered exemplary in nature since many other architectures can be implemented to achieve the same functionality.

The process parameters and sequence of steps described and/or illustrated herein are given by way of example only and can be varied as desired. For example, while the steps illustrated and/or described herein may be shown or discussed in a particular order, these steps do not necessarily need to be performed in the order illustrated or discussed. The various exemplary methods described and/or illustrated herein may also omit one or more of the steps described or illustrated herein or include additional steps in addition to those disclosed.

While various embodiments have been described and/or illustrated herein in the context of fully functional computing systems, one or more of these exemplary embodiments may be distributed as a program product in a variety of forms, regardless of the particular type of computer-readable media used to actually carry out the distribution. The embodiments disclosed herein may also be implemented using software modules that perform certain tasks. These software modules may include script, batch, or other executable files that may be stored on a computer-readable storage medium or in a computing system. In some embodiments, these software modules may configure a computing system to perform one or more of the exemplary embodiments disclosed herein.

In addition, one or more of the modules described herein may transform data, physical devices, and/or representations of physical devices from one form to another. For example, archiving module **106** in FIG. **1** may transform a property or characteristic of archiving system **206** in FIG. **2** by creating and/or modifying archived instances **122** of data elements within archive database **120**.

The preceding description has been provided to enable others skilled in the art to best utilize various aspects of the exemplary embodiments disclosed herein. This exemplary description is not intended to be exhaustive or to be limited to any precise form disclosed. Many modifications and variations are possible without departing from the spirit and scope of the instant disclosure. The embodiments disclosed herein should be considered in all respects illustrative and not restrictive. Reference should be made to the appended claims and their equivalents in determining the scope of the instant disclosure.

Unless otherwise noted, the terms "a" or "an," as used in the specification and claims, are to be construed as meaning "at least one of." In addition, for ease of use, the words "including" and "having," as used in the specification and claims, are interchangeable with and have the same meaning as the word "comprising."

What is claimed is:

**1**. A computer-implemented method for archiving related items, at least a portion of the method being performed by a computing device comprising at least one processor, the method comprising:

identifying a data element on the computing device, wherein identifying the data element comprises identifying an email;

identifying at least one additional data element on the computing device that is related to the data element, the data element and the additional related data element collectively comprising a group of related data elements, wherein identifying the additional data element that is related to the data element comprises:

identifying a conversation thread of which the email is a part;

identifying at least one additional email from the same conversation thread of which the email is a part;

prior to archiving any of the data elements within the group of related data elements, determining, by applying an archiving policy to the group of related data elements, that each data element within the group of related data elements is eligible for archiving;

archiving the group of related data elements only upon determining that each data element within the group of related data elements is eligible for archiving.

**2**. The method of claim **1**, wherein identifying the data element comprises receiving a request to archive the data element.

**3**. The method of claim **1**, wherein identifying the additional data element that is related to the data element comprises determining that the additional data element shares at least one property in common with the data element.

4. The method of claim 3, wherein the property comprises at least one of:

a file name;

a file size;

a file-creation date;

a file-modification date;

a file author;

file content;

a file type.

5. The method of claim 3, wherein the property comprises at least one of:

an email recipient;

an email sender;

an email subject line;

email content;

an email file size;

an email attachment;

an email-attachment file size;

an email send date;

an email receive date.

6. The method of claim 1, wherein applying the archiving policy to the group of related data elements comprises determining whether each data element within the group of related data elements satisfies criteria relating to at least one of:

a file name;

a file size;

a file-creation date;

a file-modification date;

a file author;

file content;

a file type;

a file property.

7. The method of claim 1, further comprising assigning a unique identifier to the group of related data elements.

8. The method of claim 1, further comprising removing the group of related data elements from the computing device.

9. The method of claim 1, further comprising:

receiving a request, via a reference, to apply an operation to the group of related data elements;

applying the operation to the archived group of related data elements.

10. The method of claim 9, wherein the operation comprises at least one of:

a search operation;

a delete operation;

a retrieve operation;

a file operation.

11. The method of claim 10, wherein applying the search operation comprises:

determining that a plurality of data elements within the group of related data elements satisfy a search query;

returning a single search result for the entire group of related data elements, as opposed to returning a separate search result for each data element within the group of related data elements that satisfies the search query.

12. A system for archiving related items, the system comprising:

an identification module, stored in memory, that:

identifies a data element on a computing device, wherein identifying the data element comprises identifying an email;

identifies at least one additional data element on the computing device that is related to the data element, the data element and the additional related data element collectively comprising a group of related data elements, wherein identifying the additional data element that is related to the data element comprises:

identifying a conversation thread of which the email is a part;

identifying at least one additional email from the same conversation thread of which the email is a part;

an archiving module, stored in memory, that:

determines, prior to archiving any of the data elements within the group of related data elements, that the entire group of related data elements is eligible for archiving by applying an archiving policy to the group of related data elements;

archives the group of related data elements only upon determining that each data element within the group of related data elements is eligible for archiving;

at least one hardware processor configured to execute the identification module and the archiving module.

13. The system of claim 12, wherein the identification module identifies the additional data element that is related to the data element by determining that the additional data element shares at least one property in common with the data element.

14. The system of claim 12, wherein the archiving module applies the archiving policy to the group of related data elements by determining whether each data element within the group of related data elements satisfies criteria relating to at least one of:

a file name;

a file size;

a file-creation date;

a file-modification date;

a file author;

file content;

a file type;

a file property.

15. The system of claim 12, wherein the archiving module is further programmed to assign a unique identifier to the group of related data elements.

16. A non-transitory computer-readable medium comprising computer-executable instructions that, when executed by at least one processor of a computing device, cause the computing device to:

identify a data element on the computing device, wherein identifying the data element comprises identifying an email;

identify at least one additional data element on the computing device that is related to the data element, the data element and the additional related data element collectively comprising a group of related data elements, wherein identifying the additional data element that is related to the data element comprises:

identifying a conversation thread of which the email is a part;

identifying at least one additional email from the same conversation thread of which the email is a part;

determine, prior to archiving any of the data elements within the group of related data elements, that the entire group of related data elements is eligible for archiving by applying an archiving policy to the group of related data elements;

archive the group of related data elements only upon determining that each data element within the group of related data elements is eligible for archiving.

17. The non-transitory computer-readable medium of claim 16, wherein the computer-readable instructions cause

the computing device to identify the data element by causing the computing device to receive a request to archive the data element.

**18**. The non-transitory computer-readable medium of claim **16**, wherein the computer-executable instructions further cause the computing device to remove the group of related data elements from the computing device.

**19**. The non-transitory computer-readable medium of claim **16**, wherein the computer-executable instructions further cause the computing device to:

receive a request, via a reference, to apply an operation to the group of related data elements;

apply the operation to the archived group of related data elements.

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